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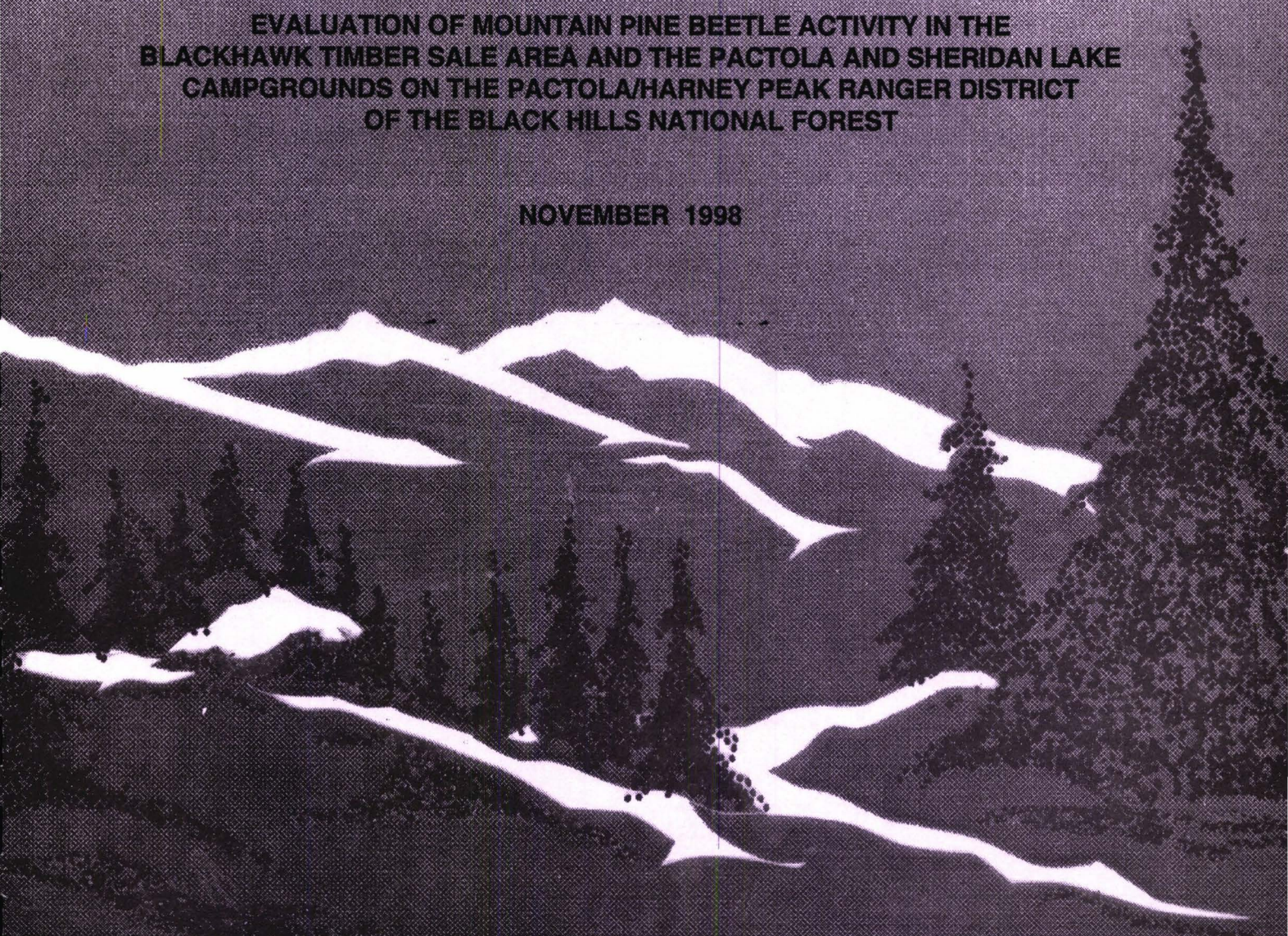
Forest Health Management

BIOLOGICAL EVALUATION
R2-99-04

EVALUATION OF MOUNTAIN PINE BEETLE ACTIVITY IN THE BLACKHAWK TIMBER SALE AREA AND THE PACTOLA AND SHERIDAN LAKE CAMPGROUNDS ON THE PACTOLA/HARNEY PEAK RANGER DISTRICT OF THE BLACK HILLS NATIONAL FOREST

NOVEMBER 1998



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ABSTRACT

Mountain pine beetle populations have been increasing in the Black Hills, South Dakota, beginning in 1996. The 1998 aerial survey detected areas of mountain pine beetle infestation in the Blackhawk area on the Pactola Ranger District of the Black Hills National Forest. This area is comprised of forest land that has been approved for timber sale, no cut areas, and private residential lands. Ground surveys indicated that there were an average of 6.5 trees per acre killed over the last 3 years in the national forest land adjacent to the Woodland Hills residential area, with approximately 52% of these trees being attacked during the summer of 1998. In addition, nearly all of the forested land in the Blackhawk area was classified in the moderate to high stand susceptibility categories. Strategies for dealing with the mountain pine beetle include: do nothing, silvicultural treatments, sanitation/salvage harvesting, infested tree treatment and individual tree protection. The current recommendation for the Blackhawk Timber Sale area is to conduct conventional sanitation and salvage operations in combination with the timber sale and, where appropriate, for long-term silvicultural treatments outside the sale area.

In addition to the Blackhawk area, campgrounds and day use areas at the Sheridan and Pactola Lake Recreation areas were surveyed for bark beetle activity. Sanitation removal of infested trees was completed in the campgrounds of the recreation areas during the early summer of 1998. Ground surveys found a relative decrease in the number of infested green trees; however, small pockets of mortality were still observed. In addition to the recommendation for continued sanitation treatments, a limited number of high value trees may be chemically protected. Long-term silvicultural treatments of areas adjacent to the campgrounds would enhance the protection of trees in the campgrounds.

INTRODUCTION

The mountain pine beetle (*Dendroctonus ponderosae*) is the number one insect killer of pines throughout the western United States. The beetle is a native species whose hosts include most of the pine species in the West, including ponderosa pine, which it attacks in the Black Hills of South Dakota and Wyoming.

The mountain pine beetle has one generation per year in the Black Hills. Adult flight typically occurs between July and August, when adults leave previously infested trees and attack uninfested, green trees (i.e., trees having needles that are still green). The adults chew through the bark of green trees and construct galleries along which eggs are laid. Larvae emerge from the eggs and begin feeding on the phloem of the tree in late summer to early fall. Larvae, pupae, or callow adults can overwinter under the bark of the infested tree. In the spring, the beetle finishes its maturation process, producing the next generation of adults.

Populations of the mountain pine beetle are usually found at an endemic level, killing and reproducing in stressed or weakened trees, including lightning strikes. Less than one tree per acre per year killed is considered to be an endemic level. For reasons that are not fully understood, beetle populations can increase dramatically over a few years. The beetles go through an increasing stage (more than 1 tree per acre per year killed, but less than 10% of the stand affected over a 3 year period) and finally into an epidemic stage where 10% or more of the stand is affected in a 3 year period (Lessard 1982). In the increasing and epidemic stages, healthy trees are attacked and killed in addition to stressed trees.

The beetle always has been a part of the Black Hills forest ecosystem, with outbreaks occurring periodically. The first recorded outbreak in the Hills occurred from the late 1890's through the early 1900's and killed an estimated 1-2 billion board feet of timber . Outbreaks also have occurred in the 1930's, 1940's, 1960's and 1970's, each lasting 8-13 years with the 1970's outbreak being larger and causing more mortality than any of the others (Thompson 1975). The most recent outbreak occurred from 1988-1992 in the Bearhouse Area on the Harney Ranger District and ended up killing over 50,000 trees (Pasek and Schaupp 1992). Outbreaks of the beetle can cause considerable changes in forested stands, including a reduction in average stand diameter and stand density (McCambridge et al. 1982). Mortality levels of 25% can be expected throughout the landscape surrounding outbreak areas and levels of up to 50% can occur in heavily attacked stands (McCambridge et al. 1982). The levels of mortality caused in an epidemic and the associated change in stand structure and composition can be undesirable: it reduces timber stocking levels, can affect wildlife habitat, can increase short term fire risks, and can negatively effect visual and recreation values.

Pine stands in the Black Hills can be categorized in their susceptibility to beetle attack. In general, stands are considered to be most susceptible when 75% of the stand is in the 7-13 inch diameter range and the stand density is over 120 feet of basal area per acre (Stevens et al. 1980, Schmid and Mata 1992). These general hazard rating guidelines, and most stand inventory data, are based on stand averages; small pockets that have high stocking levels within a low density stand can be a focal point for beetle buildup. Stand hazard ratings give an indication of which stands are most probable to have the initial beetle infestations. Once an

outbreak has started, any stands containing suitable host material can incur damage. These ratings also give no indication of local beetle pressure. However, hazard ratings can determine which stands should be given priority in treatment to minimize beetle susceptibility. They also point out that forest management strategies that decrease stocking densities is often the best approach to reduce long-term losses to the mountain pine beetle.

Aerial surveys of the Black Hills are conducted annually at the end of summer. These surveys are used to detect pines that have been killed in the last 1-2 years and whose crowns have faded. For the last few years, beetle mortality has been very light and scattered throughout the Hills. In 1997, there was a noticeable increase in observed tree mortality that had been attacked in 1996. The 1998 survey again showed a sharp increase from 1997, with much of the heaviest damage concentrated into a few areas. One area that had concentrated pockets of mortality was the area west of the Blackhawk near the subdivision of Woodland Hills on the Pactola Ranger District. The campgrounds surrounding Sheridan and Pactola Lakes also represent areas that have an ongoing history of bark beetle problems. Sanitation treatments took place in both campgrounds during the beginning of 1998.

As a result of the beetle situation in these areas, and the fact that there is a planned timber sale in the Blackhawk area, the district may need to re-mark the sale area. The focus of this evaluation is to examine the bark beetle situation in these areas and determine which management alternatives should be implemented.

METHODS

The current mountain pine beetle conditions for the national forest areas adjacent to the Woodland Hills and Rolling Hills residential subdivisions were estimated using two methods: Aerial survey data (trees killed in 1997) and strip cruises to estimate the number of green, infested trees and the ratio of green attacked trees to attacks occurring in previous years. Stand hazard ratings based on RIS data were not possible because stands in these areas were not in the current RIS database.

The aerial survey was conducted in late August 1998. The number of fading trees and their approximate location were mapped.

Strip cruises were run throughout the Woodland Hills and Rolling Hills areas in November 1998. Cruise lines varied in length between 1 and 2 miles and were approximately 1 chain wide, covering an area between 8 and 16 acres per line. Along each cruise line, recently attacked trees were counted. Attacked trees were broken into four categories:

New beetle hits-1998 (green trees),
One year old hits-1997,
Two year old hits-1996,
Current pitchouts (attacked trees that probably will survive).

A total of 5 cruise lines were run, covering 5.5 miles (44 acres) and 1 mile (8 acres) throughout the Woodland Hills and Rolling Hills areas, respectively, for a total of 52 acres evaluated (Figure 1). On each line, variable radius prism (BAF 10) plots were measured every 1/4 mile, for a total of 4 per mile. Diameter at breast height (DBH) was taken for all "in" trees in each plot. These measurements were used to provide an estimate of basal area (BA) in square feet per acre and DBH in inches within the cruise lines.

For the Sheridan and Pactola Lake Recreation Areas, small pockets of beetle caused tree mortality were noted in or very near each campground from the 1998 aerial survey. In addition, a larger, ongoing area of beetle activity was located near Pactola Campground, in stands around Silver City. Ground surveys of campgrounds and day use areas were conducted in November of 1998 to determine the levels of current beetle activity. Each campsite was visited along with about 60 feet into the forest surrounding each campground. Pockets of recently killed (1- and 2-year-old dead trees) and green, beetle infested trees were recorded. Also, unsuccessful attacks, or pitchouts, were noted.

RESULTS

The aerial survey from 1998 detected a total of 11,383 trees killed throughout the Black Hills. 9,863 of these were on National Forest Lands in South Dakota. This is an increase from the 4,576 trees killed on National Forest lands in 1997. The majority of the damage was concentrated in pockets of 25 trees or more in a few concentrated areas. Approximately 260 trees were killed by beetles in or adjacent to the Blackhawk Timber Sale area according to the 1998 aerial survey.

The strip cruises provide information on the current levels of beetle infestation, average tree diameter, and stand density. Table 1 lists the number of beetle killed trees found on all cruise lines in 1998 ground survey for the Woodland Hills and Rolling Hills areas. Mortality from 1996, 1997, and green infested trees show that there are about 6.5 trees killed per acre throughout the Woodland Hills area. Beetle populations based on the number of dead trees increased about two and 1/2-fold and one and 1/2-fold in 1997 and 1998, respectively. The populations in this area constitute an increasing phase or approaching epidemic levels. However, beetle activity in the Rolling Hills area was limited to less than 1 tree killed per acre and, therefore, represents an endemic level.

Table 2 lists the number of attacks by cruise line in the Woodland Hills and Rolling Hills areas, along with average basal area and diameter of trees along that line. In ponderosa pine forests, beetles typically kill trees in pockets that tend to grow larger over time and, therefore, show up in clumps. The areas having the largest concentrations of beetles were on the east side of road 149.3 and on the north side of road 777.1C. However, moderately large beetle pockets, 5-10 trees, can be found scattered throughout the areas bordering, and within, the Woodland Hills residential subdivision. The average diameter at breast height in the Woodland Hills area ranged from 8 inches to 11 inches, providing suitably sized material for beetle infestation. The average basal area ranged from 125 to 170, with most being approximately

150 square feet per acre. Therefore, most of the area was characterized as being high beetle hazard.

The current stand conditions do not seem to be as susceptible to MPB damage in the Rolling Hills area compared with Woodland Hills. The average diameter at breast height was less than 9 inches and average basal area was less than 100 square feet per acre. In addition, many of the stands west of road 149.5 appeared to be "dog-hair" thickets composed of small diameter trees, which are generally not conducive to beetle outbreaks. Green attacked trees were only detected adjacent to the west side of road 149.5 near the junction of road 149.5A.

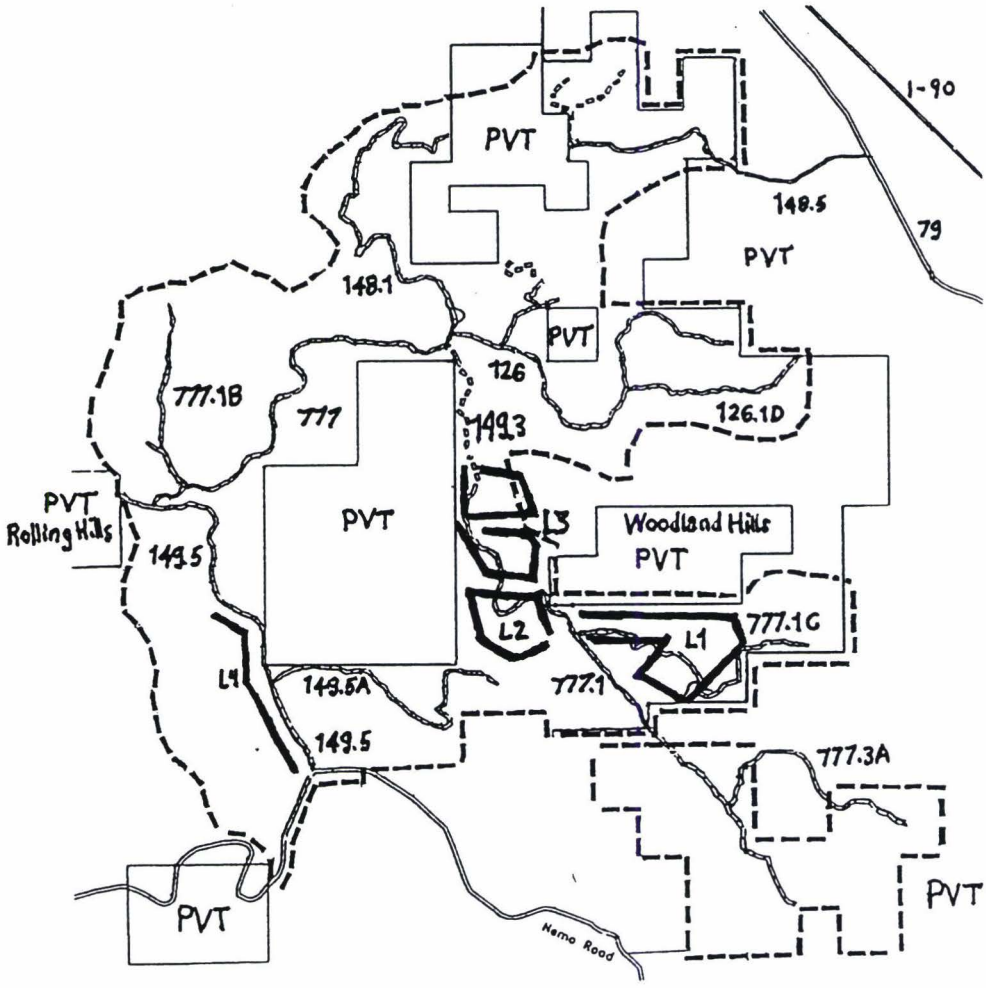

Fig. 1. Mountain pine beetle cruise lines relative to forest road system near the Woodland Hills and Rolling Hills subdivisions of Blackhawk, SD. Heavy solid lines show location of cruise lines. Heavy dashed lines signify border of timber sale.

Table 1. Number of mountain pine beetle attacked trees along 6.5 miles of cruise lines in the Woodland Hills and Rolling Hills areas near Blackhawk, SD, Pactola Ranger District, and the ratio of attack frequency between years.

Number of Trees Attacked

Year	Total Trees Attacked (44 acres)	Attacked Trees Per Acre
Woodland Hills		
1996 Dead	39	0.9
1997 Dead	98	2.2
Green Infested	156	3.4
1998 Pitchouts	21	0.5
All Attacks 1996-1998	314	7.0
Rolling Hills		
1996 Dead	0	0.0
1997 Dead	0	0.0
Green Infested	4	0.5
1998 Pitchouts	5	0.6
All Attacks 1996-1998	11	1.1

Ratio of Attack Frequency Between Years for Woodland Hills

1996:1997 --- 1:2.5

1997:1998 --- 1:1.5

1996:1998 --- 1:4.0

Table 2. Number of trees attacked per acre by mountain pine beetle, average tree diameter, and basal area by cruise line in the Woodland Hills and Rolling Hills areas near Blackhawk, SD.

Line	Location	Trees per acre killed, year of attack 1996	1997	1998	Mean DBH	Mean BA
Woodland Hills						
1	South and North of 777.1C	0.3	2.1	3.5	10.0	148
2	East and West of Road 149.3	0.9	2.2	1.8	8.3	170
3	East of Road 149.3	1.4	2.4	4.9	11.1	125
Rolling Hills						
4	East of Road 149.5	0.0	0.0	0.5	8.9	98

In the Pactola Campground, a total of 23 beetle attacked trees were detected, including: 11 old trees, 12 green, infested trees, and 0 pitchouts. The approximate location of these attacks are listed in Table 5. In addition to these numbers, there also were pockets of green and dead trees across the inlet from the marina. Also, not all pitchouts were noted in the campground. Pitchouts are trees that have been unsuccessfully attacked by the beetles and will not die from the attack. However, these trees are more susceptible to future attack and may be considered for removal. Small pockets of green infested and dead trees were found in the cruise lines behind the Pactola Pines store and the Pactola Campground (Tables 4 and 5). The pockets of green infested trees should receive attention at the same time sanitation practices are implemented in the campground areas. The average tree diameter and average basal area conducive to continued beetle population build up in these areas.

In the Sheridan Lake Campground, a total of 34 beetle attacked trees were found, including: 19 old, dead trees, 15 green, infested trees and 4 pitchouts. The approximate location of these attacks are listed in Table 3. Pockets of mortality were not observed in the forest immediately adjacent to the campgrounds.

Table 3. Number of trees attacked by mountain pine beetle according to the year attacked and location of attack in the Sheridan and Pactola Lake campgrounds, Black Hills National Forest, SD.

Location	Number of trees attacked			
	1996	1997	1998	Pitchouts
Sheridan Lake Recreation Area				
Rocky Loop	0	0	0	2
Site 104 (Thumper Loop)	0	0	1	0
Site 72 (Chipper Loop)	0	0	2	0
Sites 84/85 (Chipper Loop)	4	2	1	0
Site 44 (Woodsy Loop)	0	7	1	0
Site 37 (Smokey Loop)	0	0	2	0
South Beach Picnic Ground	2	0	5	2
Susie Squirrel Group Campground	0	0	2	0
Ranger Rick Group Campground	0	0	1	0
Pactola Reservoir Recreation Area				
Pactola Lake Campground				
Site 76 (Loop B)	0	0	1	0
Site 29 (Loop A)	0	0	6	0
Site 34 (Loop A)	0	2	1	0
Site 19 (Loop C)	0	2	2	0
Bear Gulch Campground	0	0	0	0
Jenny Gulch Picnic Ground	2	5	2	0

Table 4. Number of mountain pine beetle attacked trees along 2.25 miles of cruise lines in the Black Hills National Forest adjacent to the Pactola Reservoir Recreation Area, SD, Pactola Ranger District.

Year	Number of Trees Attacked Total Trees Attacked (18 acres)	Attacked Trees Per Acre
1996 Dead	8	0.4
1997 Dead	19	1.1
Green Infested	29	1.6
1998 Pitchouts	5	0.3
All Attacks 1996-1998	61	3.4

Table 5. Number of trees attacked per acre by mountain pine beetle, average tree diameter, and basal area by cruise line on the Black Hills National Forest adjacent to the Pactola Reservoir Recreation Area.

Line	Location	Trees per acre killed, year of attack			Mean DBH	Mean BA
		1996	1997	1998		
1	South side of Road 258 (behind Pactola Pines Store)	0.9	0.9	1.9	11.4	118
2	West side of Road 545 (behind Pactola Campground)	0.1	1.2	1.4	8.3	170

CONCLUSIONS

The number of trees attacked and the buildup ratios for the Blackhawk area are typical for the Black Hills. The number of trees per acre attacked in one year has been as high as 26.8, on the Spearfish District in the beetle epidemic of the 1970's (Creasap and Minnemeyer 1976) and 61.4 and 41.6 in the Bearhouse area in the early 1990's (Pasek and Schaupp 1992). Year-to-year attack ratios of 1:2 or 1:3 are fairly common during population buildups.

In the Woodland Hills area, MPB can be considered to be in the increasing phase or approaching the epidemic phase. There were a few spots where almost every tree had been killed and many of the spots had green infested trees that will produce beetles in the summer of 1999. The overall attack ratio from 1997 to 1998 was 1:1.5; however, there were a number of places where that ratio was much higher. Stand conditions in this area are conducive to sustaining high levels of beetle-caused mortality, as most stands were densely stocked with trees that are in diameter classes that the beetles prefer (7-13 inches). Once beetle populations get started, the beetles can infest any surrounding stands that have suitable diameter material, because of the high level of beetle pressure in the area. The use of sanitation harvests to help lessen the impact of beetles may take 2 or 3 years of revisiting a site before most of the activity is stopped. All infested trees that were examined had live brood in them, mostly larvae.

A general observation from the ground surveys was that there was considerable woodpecker activity in the Woodland Hills area. Woodpeckers are a natural enemy of the beetles that eat the larvae as they are maturing under the bark. At this point it is unknown what percentage of the beetles will overwinter successfully; however, with the number of new attacks, woodpeckers and other natural enemies will not impact beetle populations enough to stop the outbreak.

Only endemic levels of MPB were observed in the Rolling Hills area. Based on the current stand conditions, this area is characterized by low to moderate hazard ratings. Because no mortality of trees was detected for the 1996 and 1997 years, the green attacked trees probably resulted from beetles immigrating from the Woodland Hills or Steamboat Rock (Allen and McMillin 1999) areas.

Bark beetles likely will continue to develop and kill pockets of trees within the campgrounds and surrounding areas at Sheridan and Pactola Lakes. However, the sanitation work accomplished for the Pactola Lake Campground in 1998 probably contributed to a decrease in the number of newly infested trees; only 12 infested green trees were detected in 1998 compared with 32 in 1997. The number of green attacked trees in 1998 (15) in the Sheridan Lake Campground was similar to the previous year (20). The fact that trees killed in 1997 were found in the campgrounds during this year's ground survey suggests that some infested trees were missed in the 1998 sanitation project and that there were an ample number of beetles present for new infestations. How much damage is sustained within the campgrounds from year to year is difficult to estimate, but without treating infested trees, the problem will persist. In addition to managing the campgrounds, forest land adjacent to the campgrounds should be addressed as part of the overall plan. For example, although no dead trees were detected in the Bear Gulch Campground proper, pockets of mortality were observed in the forest nearby. The pockets of infested trees will provide a source of beetles for future attacks.

Likewise, with the current outbreak near Silver City, there is a nearby population of beetles available to reinfest Pactola Campground.

ALTERNATIVES

There are a number of actions that can be used to reduce the impacts of mountain pine beetle in this area. These actions fall into two categories: direct action against the beetles themselves or indirect action which addresses the general stand conditions. Direct action deals with the symptoms (e.g., too many beetles in one place at one time), and is aimed at directly reducing the number of beetles present. Indirect action is focused on the cause of the problem. For example, stand conditions that are adequate for beetle buildup and outbreak (e.g., dense stands comprised of medium to large diameter trees).

The only effective long-term strategy to minimize beetle-caused mortality is controlling stand conditions silviculturally over entire landscapes and constant monitoring for areas of beetle buildup.

Alternative 1: Do Nothing. Accept that MPB caused tree mortality and the impacts associated with it as a natural process. The extent of the damage to the stands in this area and surrounding areas is difficult to estimate, but there will probably be significant changes in the forest caused by beetles.

Where to use: Use where other alternatives are not desired or cannot be used.

Advantages: There is no mechanical site disturbance. There will be an increase in the amount of light getting to the forest floor, so that understory species and regeneration may be enhanced. Habitat for some wildlife species may be enhanced due to decreasing crown closure and creation of standing dead trees.

Disadvantages: This alternative allows beetle populations to increase and spread to other trees and surrounding areas. There is a loss in timber revenues from either not harvesting beetle killed trees or letting the infestation grow and increasing the amount of killed timber. Fire hazards can increase with an increase in dead material, including red, dry needles. Visual and recreation values can be negatively affected. The loss of overstory tree cover can have a negative effect for some wildlife species. Regeneration can be impeded as dead trees fall and cover or shade the forest floor.

Alternative 2: Silvicultural Treatment. These are actions that increase tree vigor and reduce stand susceptibility to beetle attack. It is a preventative treatment that must be done prior to stands experiencing beetle outbreaks. In the Black Hills, stands that are under 80 square feet of basal area per acre with average stand diameters of under 7 inches are at the lowest

risk. When treating stands care must be taken to avoid leaving pockets of dense trees in an otherwise thinned stand.

Where to use: This is a preventative tactic and should be used regularly when planning timber harvests. It is not a tool in stands currently experiencing a beetle outbreak.

Advantages: Silvicultural treatment can reduce overall stand susceptibility to beetle infestation. However, this treatment does not guarantee that beetle caused mortality will be eliminated, it creates conditions that are less prone to experience a beetle outbreak. It maximizes the economic return from timber sales, as cutting is done prior to mortality taking place. Although the forest will experience mortality through time, treating stands silviculturally allows the decisions on what the forest will look like in the future through the types of harvesting implemented. If not, the beetles will decide what the forest will look like in the future through their actions, and this may be considerably different than what is desired.

Disadvantages: This action is not suitable for areas where timber harvest is not feasible. Building of roads (if required) and cutting and removal of trees can create site disturbances.

Alternative 3: Sanitation/Salvage Harvest. Sanitation harvesting involves removing currently infested pines prior to the beetles maturing and leaving to infest new trees. It requires the removal of green trees that have live brood in them. These green trees are already dead; however, the foliage will not change color until the following summer. Trees removed in a sanitation harvest are treated prior to beetle emergence by either moving them to at least one mile from the nearest live host type or by processing them at the mill. Salvage harvest involves the removal of beetle-killed trees that do not have live beetles in them. These trees have already changed color, their needles are either red or gone.

A relatively new, and largely experimental, approach to the sanitation of bark beetles includes the use of semiochemicals (e.g., pheromones produced by the beetles for aggregation or anti-aggregation behavior). One method that is used in combination with traditional sanitation practices involves baiting trees with aggregation pheromones in concentrated areas or on a grid system just prior to the adult flight period. After the trees are infested, the trees **must** be removed and treated as stated above. A spillover effect (i.e., neighboring trees of the baited trees are also attacked) is commonly experienced when using this technique, and these neighboring infested trees also must be removed and processed.

Where to use: Stands susceptible to MPB that are currently under attack and where it is desirable to reduce MPB populations and recover timber resource value. Also appropriate where beetle populations threaten currently uninfested nearby stands.

Advantages: MPB populations can be reduced in localized areas and in individual stands by removing most of the currently infested trees. The use of baits concentrates and contains beetles within the current infestation boundaries. This can provide some protection to surrounding uninfested trees and stands by removing a large source of attacking beetles. Timber values are recovered that would otherwise be lost or degraded. Fuel loading and fire hazard

can be reduced by removal of much of the dead needles and timber. Regeneration can be enhanced through overstory removal and site disturbance.

Disadvantages: This alternative has a short implementation time. Areas must be marked and cut prior to beetle flight, July - early August, in the Black Hills. Sanitation will not be effective on a large scale. It is only effective at suppressing beetles at the stand level and, therefore, will not work on a landscape level or when there is a chance of beetles reinfesting the treated area. Site disturbance that accompanies timber harvest occurs.

Alternative 4: Infested Tree Treatment. Cut and individually treat infested trees prior to beetle emergence. The action should kill most or all of the beetles within the cut trees. Examples of treatments include: cut and burn on site, cut and bury at least 6 inches on site, cut and chip, cut and debark, or cut and treat with a chemical insecticide.

Where to use: This is most appropriate for treating small spots in areas where high value resources are nearby. It can be used in areas that are unroaded or too steep for conventional sanitation or salvage harvesting.

Advantages: Beetle populations can be reduced or eliminated from the treated area. This can provide some relief to surrounding uninfested stands and trees. The site disturbance is less than in conventional harvesting operations. Regeneration can be enhanced through the removal of overstory trees. Fire hazard can be reduced.

Disadvantages: The implementation time for this alternative is short. Treatments must be implemented after new infested trees are located and prior to beetle flight. This treatment only reduces beetle pressure in a small area, it is not effective on a landscape scale. This treatment does nothing to address stand conditions that led to beetle buildup in the first place.

Alternative 5: Protection of High Value Trees. Prior to beetle emergence in the summer, the stems of high value trees are treated with a registered insecticide.

Where to use: On trees around residences and in campgrounds. Trees must be of significantly high value and be under heavy beetle pressure to justify treatment costs.

Advantages: This action is very effective at protecting individual trees from becoming infested.

Disadvantages: Insecticide application does not effectively reduce beetle populations or address the cause of the outbreak. It does not guarantee protection, application must be thorough for it to be effective. Many people have concerns regarding environmental contamination when using pesticides. It is extremely expensive, it is only appropriate for a single or a few high value trees.

RECOMMENDATIONS

Woodland Hills Area

In this area, we recommend a combination of alternatives 2 and 3.

Alternative 2, silvicultural treatments, is better used during long range planning processes. Those stands in this area that can be manipulated need to have this done on a regularly scheduled basis to avoid future outbreaks.

Alternative 3, sanitation and salvage logging, is strongly recommended in combination with the timber sale and in those areas where it is permissible outside the sale. This action would need to be carried out in a short time frame, before the end of June 1999, to reduce beetle populations. This possibly could include the use of tree baiting on a limited basis in an attempt to pull the beetle population to areas that are designated for harvesting in the near future.

If there are no treatments carried out in this area, beetle populations will continue to grow and mortality will increase. The extent of damage that will occur, and how long it will continue, are difficult to state at this point in time; however, stands that are in close proximity to this area will remain at risk.

Rolling Hills Area

In this area, alternatives 2 and 3 also are recommended. Both of these alternatives should be implemented in combination with the planned timber sale and made part of the long-term planning processes. Those stands in this area that can be manipulated need to have this done on a regularly scheduled basis to avoid future outbreaks. The only observed area that needs sanitation at this time is on the east side of road 149.5 near the junction of 149.5A.

Sheridan Lake and Pactola Lake Campgrounds

At this time, the sanitation/salvage alternative is recommended in the campgrounds. Of particular importance is the sanitation, removal of green infested trees. This will reduce the population of beetles in the campgrounds proper, thereby removing a local source of reinfestation. Removal of standing dead (salvage) could also be accomplished at this time, as a means of reducing potential future hazard trees in the campgrounds. Alternative 2, silvicultural treatments should be considered for the campgrounds and surrounding areas in the future. Alternative 5, protection of high value trees, should be considered for specific, high value trees. In addition, a thorough hazard tree analysis of the campgrounds should be undertaken, and stressed or weakened trees could be removed as part of this program. This should be done as part of an overall vegetation management plan for each campground, which would include future treatments and regeneration of the sites. Surrounding areas that could be a source of beetles for reinfestation, such as the areas around Silver City, should be examined for possible treatment.

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